SEAL RING AND INK CARTRIDGE USING THEREOF

FIELD OF THE INVENTION

The invention relates to seal rings used for ink jet recording device and to ink jet recording devices which use the seal rings.

BACKGROUND OF THE INVENTION

Ink jet recording equipment, for example, ink jet printers, often uses replaceable ink supply devices such as ink cartridges. There are many methods to supply ink to ink jet recording equipment. In one method, the recording device is equipped with an ink supply needle that has an ink passageway. Upon insertion into the ink outlet of the ink supply device, the ink supply needle passes the ink from the ink supply device to the printing head of the recording device. To allow the ink flow only through the ink passageway, the outlet of the ink supply device is equipped with a seal ring. Often there is an aperture on the seal ring which is mounted on the needle to prevent the ink from flowing out through the gap between the needle and the seal ring. One fault of this method is that when an unexhausted ink cartridge is removed from the recording device, the ink leaks through the aperture. Often the ink indicator shows the ink is exhausted although it is not. The ink leakage contaminates the surroundings and dirties the cloth of workers. Placing the unexhausted ink supply device back to the recording device also causes poor printing results.

There is a known technology which overcomes the above problem. The technology is shown in Figure 14. To illustrate, Figure 14 only shows the outlet part of the ink cartridge. According to Figure 14, a valve 16 is equipped inside the seal ring 18 of the ink outlet; the valve 16 consists of a valve rod and a valve surface. A spring 17 is equipped between the top of the ink outlet and the valve surface. Under the force of spring 17, the valve surface tightly seals the top opening of the seal ring 18. The ink outlet of a new ink cartridge is often sealed with a film 20. After the ink cartridge is placed on the recording device, see Figure 15, the ink supply needle 19 punches through the film 20, passes

through the opening of the seal ring 18, opens the valve surface, enters the ink chamber, and thus allows the ink from the ink chamber flow through the passageway of the ink supply needle 19. The opening of the seal ring 18 is tightly mounted on the needle, preventing the ink from leaking out. When the ink cartridge is removed from the recording device, the ink supply needle 19 is withdrawn and the valve 16 under the force of the spring 17 resumes sealing the opening of the seal ring 18, preventing remaining ink from leaking out.

The above technology avoids the ink outflow when the ink cartridge is removed. However, it has a complex structure that is difficult and costly to make. Because the valve is made from rigid material, it may cause the ink supply needle, which repeatedly presses the valve, to wear and tear fast.

Additionally, the ink supply needle is in cantilever state, it cannot be firmly fixed, and thus it may become crooked after extensive use.

DESCRIPTION OF THE INVENTION

The main object of the invention is to provide a seal ring which has the valve function.

Another object of the invention is to provide a seal ring which can fasten the ink supply needle when the needle pouches through the seal ring.

An additional object of the invention is to provide an ink cartridge which uses such seal ring.

To realize the above objects, the seal ring of the invention comprises a tube-shaped, elastic part. The low end of the elastic part has an up-extending, ink supply needle leading-in opening. The needle leading-in opening is not in its natural state. Instead, the top of the opening is sealed with a film of certain thickness. The center of the sealing film has a crack which connects the inner part of the opening with the space above the sealing film. The crack closes when it is under no strain and thus prevents liquid from

leaking through. It allows the ink supply needle to pass through and tightly mounts on the ink supply needle to prevent the ink from leaking.

To fasten the ink supply needle, the leading-in opening can be designed as a notch shape. The diameter of the notch is smaller than that of the ink supply needle. Thus, when the ink supply needle passes through the notch, the notch firmly holds the needle, preventing the needle from becoming crooked.

In practice, the notch is ring-like, axially raised from the bottom of the elastic part.

For the recording device which is not often used, the ink supply needle may insert in the seal ring for more than a half year. This may cause the crack to permanently deform. After the ink supply needle is withdrawn, the crack is thus no longer able to close, resulting in ink leaking. Thus, the top of the elastic part is provided with a symmetrical support, one end of which is located on the inside wall of the elastic part and the other end is located around the top sealing film. When the ink supply needle is withdrawn, the support pushes the crack to close. Theoretically, the support increases the wall thickness around the crack and thus prevents its permanent deformation. Most preferably, the surface where the crack of the top sealing film is overlaps with the symmetric surface of the support. Thus, the recovering force of the support not only enables the crack to hold the ink supply needle tightly but also, when the ink supply needle is withdrawn, pushes the crack causing it to close. The crack which is subject to permanent deformation, otherwise, lacks the ability to close.

The ink cartridge of the invention comprises an ink outlet that supplies ink from an ink chamber. A seal ring is equipped inside the ink outlet. The seal ring is a tube-shaped, elastic part. The outer wall of the elastic part connects with the inner wall of the ink outlet and seals it. At the low end of the elastic part is a leading-in opening for the ink supply needle. The top of the leading-in opening is provided with a sealing film. The center of the sealing film has a crack which connects the inner space of the leading-in opening and the upper space above the sealing film.

BRIEF DESCRIPTION OF THE DRAWING

Figure 1 is a three-dimensional view of the first embodiment of the seal ring of the invention.

Figure 2 is a sectional view of Figure 1.

Figure 3 is a three-dimensional view of the second embodiment of the seal ring of the invention.

Figure 4 is a sectional view of Figure 3.

Figure 5 is a three-dimensional view of the third embodiment of the seal ring of the invention.

Figure 6 is a sectional view of Figure 5.

Figure 7 is a three-dimensional view of the fourth embodiment of the seal ring of the invention.

Figure 8 is a sectional view of Figure 7.

Figure 9 is a three-dimensional view of the fifth embodiment of the seal ring of the invention.

Figure 10 is a sectional view of Figure 9.

Figure 11 is a sectional view of Figure 9 from a different direction.

Figure 12 is a perspective, structural view of the ink cartridge of the invention which is placed onto a recoding device.

Figure 13 is a perspective, structural view of the ink cartridge before placed onto a recording device.

Figure 14 is a perspective, structural view of a known ink cartridge before placed

onto recording device.

Figure 15 is a perspective, structural view of the known ink cartridge which is placed onto a recording device.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The following embodiments illustrate the invention and further describe the above drawings.

Embodiment 1

As shown in Figure 1, the seal ring is a tube-shaped, elastic part. On the outer wall, there are raised ring structures 4 and 5 which are used to connect with and seal the inner wall of the ink cartridge outlet. On the top of the seal ring, there is a sealing film 1, which opens a crack 2.

Figure 2 is a sectional view of the seal ring along the vertical direction of the crack 2. As shown in Figure 2, there is a leading-in opening 6 which extends upwards. The internal diameter of the leading-in opening 6 is approximately the same as the external diameter of the ink supply needle. The top sealing film is located on the top of the leading-in opening 6. In its natural state, the leading-in opening 6 is closed. When the crack 2 opens, the leading-in opening 6 connects to the space above the top sealing film 1. The top sealing film 1 has certain thickness that enables the crack 2 to close naturally. The maximum diameter of the upper space above the top sealing film 1, where the crack 2 is located, is smaller than the diameter of the leading-in opening 6; when the ink supply needle passes through the crack, the upper space material elastically deforms to become a cylinder which tightly mounts on and seals the ink supply needle.

Embodiment 2

As shown in Figure 3, the seal ring of this embodiment looks, from its outside, the same as that of Embodiment 1. The same part numbers in this embodiment denote the

same as the previous.

Figure 4 is a sectional view of the seal ring along the vertical direction of the crack 2. A leading-in opening 6 extends upward. However, at the bottom of the leading-in opening 6, there is a narrower opening 7. The internal diameter of the leading-in opening 6 is approximately the same as the external diameter of ink supply needle, while the internal diameter of the narrower opening 7 is smaller than the external diameter of the ink supply needle. The narrower opening 7 fastens and further seals the ink supply needle. A top sealing film is located on the top of the leading-in opening 6. In its natural state, the leading-in opening is closed. When the crack 2 opens, the leading-in opening 6 connects to the space above the top sealing film 1. The top sealing film 1 has certain thickness to enable the crack 2 to close naturally. The maximum diameter of the upper space above the top sealing film 1, where the crack 2 is located, is smaller than the diameter of the leading-in opening 6; when the ink supply needle passes through the crack 2, the upper space material elastically deforms to become a cylinder which tightly mounts on and seal the ink supply needle.

Embodiment 3

As shown in Figure 5, the seal ring of this embodiment is provided with a support 8 which meets the crack 2 at right angles.

Figure 6 is a sectional view of the seal ring along the vertical direction of the crack 2. The top sealing film is a ball-like. The length of the crack 2 is the same as or a little smaller than the diameter of the leading-in opening 6, i.e., the same as or a little smaller than the diameter of the ink supply needle. As shown in Figure 6, the diameter of the narrower opening 7 is smaller than that of the ink supply needle.

Embodiment 4

As shown in Figure 7 and Figure 8, the seal ring of this embodiment is essentially the same as Embodiment 3. It differs from Embodiment 3 in that it has two supports 9 and

10 which cross each other to support the crack 2. Figure 8 is a sectional view of the seal ring along the center of support 9.

Embodiment 5

For small ink cartridges, the ink outlets have small inner diameters. Therefore, the seal rings for small ink cartridges require small external diameters. For such small seal rings, the top sealing film can be designed as shown in Figures 9, 10, and 11. The top sealing film can be relatively thick to achieve better support.

Embodiment 6

Figures 12 and 13 give an example of ink cartridge which is equipped with a seal ring. To make it simple, the figures only show the structure around the ink outlet. The external wall of the seal ring elastically presses on the ink outlet of the ink cartridge. The raised rings 4 and 5 increase the sealing. When the ink cartridge is placed on a printer, the ink supply needle 13 breaks the sealing film 12, enters the narrower leading-in opening, passes through the crack, and reaches to the ink chamber 15. An ink passageway thus forms. When the ink cartridge is removed from the printer, the ink supply needle withdraws in an opposite order. The crack 2 closes due to its elastic recovery and the push from the support, and thus the ink outflow from the ink chamber 15 stops.

INDUSTRIAL APPLICABILITY

The seal ring of the invention is made from an elastic material. It differs from those known in that it is provided with a top sealing film. The size of the top sealing film varies according to the ink supply needle of the recording device, elasticity of the material, and many other factors. The ink cartridges of the invention, due to the use of the seal ring, not only work better, but also have much simpler structures compared to known products. It not only resolves the ink leakage problem that occurs when the ink cartridge is placed on or taken away from a printer, but also provides better protection to the ink supply needle. Accordingly, it reduces the manufacture cost.